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Effects of periodic application of cattle slurry on soil microbial biomass in an Andisol grassland

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Dairy farming is an important agricultural industry in northeastern of Japan. Large amounts of cattle wastes are produced in dairy farms. Most of the wastes are used in the production of compost. In some cases, slurry originating from cattle waste is periodically applied to farmlands as a fertilizer. Mizota *et al*. (2006) investigated the fate of nitrogen compounds in the soil after the application of cattle slurry to an Andisol grassland with a focus on temporal changes in chemical composition and the natural abundance of nitrogen isotopes. Although they mentioned that microbial action might contribute to the transformation of nitrogen in the soil, the microbial characteristics of the study site have not been investigated. The purpose of this study is to investigate the microbial response of grassland soils after the application of cattle slurry.

The study was performed on an Andisol grassland located in the middle of Iwate Prefecture, northeastern Japan that was not grazed by cattle. In the study site, the dominant herbs were *Pharalis arundinacea* L. Cattle slurry from dairy farms was applied to the soil surface of the whole area in the study site in June and October 2005. In addition, 36 kg of cattle slurry was applied to the soil surface in September 2005 in small quadrats (2 x 2 m^2) set up at the middle and lower slope positions. Soil samples were collected from June to November 2005 from the upper 0-5cm soil layer in each slope position. The chemical characteristics and microbial properties of the samples were analyzed.

Application of cattle slurry caused a flush of NH_4-N release in the soil. A slight increase in the NO_3-N content followed a sharp decrease in the NH_4-N content in the soil. This showed that rapid nitrification occurred by the action of nitrifying bacteria in the soil. The colony forming units of heterotrophic, urea-decomposing and protein-decomposing bacteria in the soil fluctuated during the investigation period. The CO_2 evolution rate from the soil surface was strongly affected by the application of slurry. In contrast, soil microbial biomass C and N contents remained constant, regardless of the application of slurry. As a consequence of this, the metabolic quotient qCO_2 (microbial respiration per unit biomass) changed in parallel with the fluctuation of the CO_2 evolution rate. These results indicate that the application of slurry with high concentrations of nitrogen compounds influences the microbial quality in the soil.

References

Mizota, C., Y. Yamaguchi and K. Noborio (2006) Microbial transformation of nitrogen in cattle slurry as applied to an Andisol grassland. Journal of Japanese Society of Soil Physics, 104: 13-26.